VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

SUBJECT:	NUMBER:
Bridge Safety Inspections	**S&B-27.5**
DIRECTED TO:	**DATE:**
District Structure and Bridge Engineers	**July, 2005**
SIGNATURE:	**SUPERSEDES:**
	S&B 94-27.4 **S&B 92-59.4**

The attached instructions are intended to complement the National Bridge Inspection Standards (NBIS). The NBIS may be found in Section 23 Highways – Part 650, Subpart C of the Code of Federal Regulations. For the remainder of this document the Virginia Department of Transportation shall be referred to as the Department.

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DEFINITIONS

The 'Manual for Condition Evaluation of Bridges', published by the American Association of State Highway and Transportation Officials (AASHTO) defines five types of inspections the Department uses as guidelines to establish the appropriate level and frequency of inspection for all bridges. They are:

- Initial
- Routine
- Damage
- In-Depth
- Special

The Department uses the following criteria to define a culvert. A culvert has an integral floor system that supports the sidewalls and provides a lined channel. The opening of a culvert is typically circular, elliptical or rectangular in shape, has no distinction between substructure and superstructure and there is no deck. For the purposes of this memorandum, unless otherwise noted, the term "bridge" will encompass inventoried culverts. The inspection of ancillary structures, such as overhead sign structures, high mast lights, signal poles, luminaires, etc. are not subject to the requirements of this memorandum.

For the purposes of this memorandum, the term "Residency Administrator" may be taken as the person designated in charge of maintenance activities for a specific location or area (residency).

FREQUENCY AND LEVEL OF INSPECTIONS

In addition to structures required to be inspected by the NBIS, all structures having an opening of 36 square feet or greater will be inspected. Regardless of opening, structures not defined by the Department as a culvert are to receive an inspection at the same level and frequency as defined by the NBIS. Structures defined by the Department as a culvert and that do not meet the NBIS definition of a bridge are to receive inspections at the same level as defined by the NBIS and at a frequency not to exceed four years.

Structures that are to be inspected at intervals not to exceed one year are as follows:

- Structures that have a restricted weight limit
- Structures having a general condition rating of 4 or less on the deck, superstructure, substructure or culvert. These inspections may be performed as a 'Special' inspection limited to those items with a general condition rating of 4 or less, or as part of a 'Routine' inspection.
- Concrete structures where the reinforcing details are unknown.

Inspection frequency may also be affected by the presence of special structural details. See the Special Category Inspections section of this memorandum.

Vertical and lateral clearance restrictions to all roadways maintained by the Department caused by overhead structures shall be checked at intervals not to exceed 24 months. This shall include overhead structures owned and maintained by others such as railroad underpasses. For each overhead structure, clearances shall be documented on a sketch. This sketch shall show the

minimum vertical clearance for each lane and shall include, in accordance with Federal Item 10, the minimum vertical clearance for a ten-foot width of pavement where the clearance is greatest.

Construction activities, which will change a general condition rating or posted restriction, shall be inspected and entered into inventory within thirty days of the completion work.

Structures must be inspected in the month they are due and at a level outlined in the NBIS. To assist the Districts in assuring that all structures are inspected in the month they are due, several lists are available from the Highway Traffic Records Inventory System (HTRIS). If a structure appears on a list indicating it is past due, immediate action must be taken to correct the situation.

Municipalities and agencies that maintain structures that are required to be inspected by the NBIS are to inspect those structures at a level and frequency as defined by the NBIS. Municipalities and agencies are strongly encouraged to inspect all structures they maintain at a level and frequency equal to those set forth in this memorandum.

To assist municipalities and other agencies with the inspection of their structures, they are to be notified by the District Structure and Bridge Engineer as follows:

1. The official directly responsible for their inspection program shall be notified six months in advance of the inspection(s) being due. A copy of the correspondence shall also be sent to the official in the highest authority in the municipality or agency. This notice is to contain the following statement:

   > All structures requiring the submittal of inspection and inventory data to the Department may not appear on the list to be inspected. Bridge inspections are also required under the following circumstances:
   >
   > - All new structures shall be inspected as soon as possible to its becoming open to traffic. The inspection report and the inventory data shall be submitted to the Department within 180 days after the structure has been opened to traffic.
   > - All rehabilitated structures shall be inspected as soon as possible to its becoming open to traffic. The inspection report and the inventory data shall be submitted to the Department within 180 days after the work has been completed.
   > - All structures that have had a change in the posted load restriction shall have their updated inventory data submitted to the Department within 180 days after the date of the posting.
   > - All structures that have been closed shall have their updated inventory data submitted to the Department within 180 days after the date of the closing.

2. The official in the highest authority in the municipality or agency shall be notified monthly of any inspections that are past due. A copy of the correspondence shall also be sent to the official directly responsible for their inspection program.

3. In addition to the above correspondence, when a municipality's or agency's structure(s) are past due for three months or more, the District Structure and Bridge Engineer shall contact in writing the Local Assistance Division so they may deal with the municipality

directly. Copies of the correspondence should be sent to the Department's Chief Financial Officer and Chief Engineer, and to the municipality's or agency's official in the highest authority and to the official directly responsible for the inspection program.

FORMS AND DISTRIBUTION

All inspections shall be documented using the Department's most current computerized bridge safety inspection report.

For general condition ratings of "7" or less, detailed comments supporting these ratings are to be added to the report. In addition, photographs and/or sketches shall be made of all items which warrant a general condition rating of "4" or less.

As appropriate, the results of the latest underwater inspection shall be taken into account, and so noted on the report, when rating substructure units.

When making repair recommendations on the bridge safety inspection report, they are to be listed in priority order with the most critical items listed first. A preventative maintenance form similar to the attached may also be forwarded to the appropriate Residency Administrator. Certain categories of recommended work will require immediate action. When immediate work is necessary, the requirements detailed in the "Critical Recommendations" section of this memorandum shall be adhered to. Significant non-critical repairs should be tracked using a form similar the attached.

Each inspection report shall indicate travel time, inspection time, report generation time, special equipment used and traffic control utilized.

For bridge structures having a non-rigid overlay, the average thickness and nature of the overlay material shall be recorded in the wearing surface section of the inspection report. If it can be determined that a waterproof membrane was applied prior to paving operations, this shall also be noted.

As applicable, the presence and condition of object markers shall be noted in the "Object Marker" section of the report.

Each inspection shall include a review of the HTRIS bridge inventory sheet. Discrepancies shall be corrected and brought to the attention of the District Bridge Safety Engineer.

All inspection reports, including the inspection reports from municipalities and other agencies, are to be reviewed for quality assurance (QA) by the District Structure and Bridge Engineers or their representative. These reviews are to be documented by the reviewer initialing and dating the inspection report. For bridges maintained by the Department, quality control (QC) field reviews are to be accomplished by the District Structure and Bridge Engineers or their representative on a quarterly basis for each inspector with signature authority. A summary sheet of these QC reviews will be kept showing a record of reviews completed.

For bridges maintained by the Department, copies of all inspection reports, including all forms and attachments, are to be sent to the Structure and Bridge Division in the Central Office within three months after the inspection due date. In addition, copies of the inspection reports for Department maintained structures are to be sent to the appropriate Residency Administrator.

The District Bridge Office copy of the inspection report is the official report. The district shall maintain all official inspection reports as long as the structure is in service.

CRITICAL RECOMMENDATIONS

When the condition of a structure is identified as posing a threat to public safety, the Residency Administrator shall be notified of the situation and shall be informed of a proposed method of correction. The District Administrator shall decide to have the corrective action performed by emergency contract or by Department personnel. If an emergency contract is chosen, the guidelines set forth in the "Emergency Contract Manual" shall be adhered to.

Conditions requiring the issuance of a critical recommendation include, but are not limited to:

1. Critical repairs to fracture critical members.
2. Correction of critical scour and/or hydraulic induced problems.
3. Condition rating of 3 or less for culvert, deck, superstructure and/or substructure.
4. Appraisal rating of 3 or less for waterway adequacy.
5. Immediate work to prevent substantial reduction in safe load capacity.

Initial notification to the Residency Administrator shall be made in the most expeditious manner available. Regardless of the method used, the District Structure and Bridge Engineer will prepare a "Critical Recommendation for Posting, Repair and/or Strengthening" (attached) and transmit it to the Residency Administrator. The critical recommendation will identify the problem; provide a method of correction, including a cost estimate for the work, and a recommended time frame for the work to be completed.

As soon as practical after receiving the critical recommendation, the Residency Administrator shall fill out their portion of the form and return a copy of the form to the District Structure and Bridge Engineer. Upon receipt of the information from the Residency Administrator, the District Structure and Bridge Engineer will review the work proposed by the Residency Administrator along with the schedule for performing the work. Should the District Structure and Bridge Engineer consider the proposed work or schedule to be unacceptable, the Residency Administrator shall be notified and a mutually acceptable adjustment will be made to the proposed work and/or schedule.

When the corrective work has been completed, the Residency Administrator shall complete their portion of the critical recommendation form and return it to the District Structure and Bridge Engineer.

Upon receipt of the completed critical recommendation form, the District Structure and Bridge Engineer shall within five working days, have a follow-up inspection of the work performed. This inspection is to be documented on the critical recommendation form.

For the purpose of tracking the progress of critical recommendations, it is imperative that a copy of the initial notice to the residency and a copy of the form noting that the follow-up inspection has been completed be promptly provided to the Central Office Structure and Bridge Division. For NBIS structures, the State Structure and Bridge Engineer shall forward a copy of the form to the FHWA Division Bridge Administrator once work has been completed.

Municipalities or other agencies may use the attached alternate critical recommendation form. A copy of the initial notice and a copy of the form noting that the follow-up inspection has been completed shall be promptly provided to the District Structure and Bridge Engineer and Central Office Structure and Bridge Division. For NBIS structures, the State Structure and Bridge Engineer shall forward a copy of the form to the FHWA Division Bridge Administrator once work has been completed.

For structures not maintained by the Department, the District Structure and Bridge Engineer shall monitor inspection reports from municipalities and other agencies to identify conditions that would require a critical recommendation. If a condition is identified as requiring a critical recommendation, the District Structure and Bridge Engineer will:

1. Contact the responsible official for the municipality or agency and inquire about the status of the remedial work on the structure.
2. Emphasize to the responsible official the importance of prompt corrective action.
3. If the municipality or other agency's actions are unacceptable, notify the municipality or other agency in writing of the Department's concerns. The District Administrator or his appointed representative should sign the written notice. Dependant on the entity charged with maintaining the bridge, copies of all correspondence should be sent to the appropriate regulatory agency (e.g. the Department's Local Assistance Division should a municipality be involved.)
4. The Structure and Bridge Division will provide assistance when requested by the District.

The District Structure and Bridge Engineer or their designated representative will be responsible for updating the "Critical Recommendation Screen" in the miscellaneous update functions of HTRIS.

SCOUR AND STREAM CHANNEL DOCUMENTATION

A bridge's vulnerability to scour (coded in Federal Item 113) shall be initially determined through analysis by a hydraulic/foundation engineer and the design engineer of record. Once a structure has been placed into service, the Team Leader shall review Item 113 as a part of each inspection to determine if field conditions warrant a change.

Scour and stream channel documentation must be made at bridges over water, and when erosion problems are identified at bridges over other features. All the following documentation is not required at every bridge. Examples include bridges over gorges where the stream channel is remote from any portion of the bridge substructure, and major river crossings with deep and swift water. The team leader must use sound engineering judgment when any documentation is omitted. The reason for such omission shall be stated in the report.

Scour and stream channel documentation is required during any special inspection if changes to the streambed and/or foundation material have occurred or if the special inspection is being done because of a problem relating to scour.

If a bridge has an underwater inspection performed during the same year as the "Routine" inspection, the stream channel and scour documentation can be omitted, but only for those substructure units addressed in the underwater inspection. If the bridge is not receiving an underwater inspection during the same year but a previous underwater inspection was completed, the team leader should evaluate the existing stream channel and scour conditions to the extent

that this can be accomplished without diving. If no changes can be observed from the latest underwater inspection report, this should be noted, along with the date of the referenced underwater inspection. If changes are detected, the normal documentation should be accomplished to the extent possible and the District Structure and Bridge Engineer should be notified of the need for an immediate underwater inspection.

Channel Cross Section at Fascias

The purpose of collecting these measurements is to document changes in the waterway opening and to identify any possible lateral shift in the streambed. This identifies scour problems before they can endanger the bridge.

The channel cross section is documented relative to fixed points on the bridge. The skew angle of the flow and the depth of flow during flood events should also be estimated.

To document the cross section, take dropline readings along each fascia of all floodplain spans. Take readings along each fascia starting at the first substructure unit before the floodplain and proceed at 10-foot intervals to the substructure unit beyond the end of the floodplain. For short span bridges consider reducing the interval to 5 feet. Alternately dropline readings may be taken at each bridge rail post so long as the post spacing does not exceed 10 feet. If readings were previously taken, new readings should be taken at the same locations and referenced to the same fixed portion of the bridge. Dropline readings should be measured to a reference line on the bridge that is not likely to change with time. For example, the top of the bottom chord of a truss is a better choice than the top of the bridge railing because of possible railing replacement. Should the top of railing be used, be sure to measure the railing height relative to a more permanent reference line such as the top of deck.

Readings shall be recorded on forms similar to those shown in Figures 1 and 2.

Channel Profile Near Substructures

The purpose for collecting this information is to document streambed conditions at each substructure unit where visual inspection cannot be accomplished. This documentation is intended to determine if the streambed is either aggrading or degrading.

Channel profiles near substructure units are required whenever the depth or turbidity of the water precludes an adequate visual inspection of the stream bottom. Document the streambed profile relative to fixed points on the substructure, such as the top of footing or top of pier cap. If a rod can be used, note the depth of penetration into the streambed. Sketch any stone protection, showing dimensions.

Take readings along the face of the substructure at up to 10-foot intervals and extending approximately 25 feet beyond the end of the substructure. If the footing is exposed, take readings at the face of footing. If not exposed, take readings about 1-foot from the face of substructure.

See Figures 3 and 4 for sample sketches.

Mapping Scour and Erosion at Substructures

Documentation of scour and/or erosion consists of a sketch showing the problem location and indicating all three dimensions of the void caused by material loss. Probing loose material shall be accomplished to determine the exact limits of the void. If the problem exposes foundation piles, the condition of those piles shall be noted. Estimate the stream velocity at the time of the inspection.

See Figures 5 and 6 for sample sketches.

Stream Alignment Sketch

Any deficiencies in the stream channel that cannot be adequately shown in a photograph should be sketched in a plan view. A sketch showing the stream alignment relative to the bridge opening is generally far superior to photographs for the documentation of stream channel deficiencies.

See Figure 7 for a sample sketch.

Bridge Number: *018-1916* **Virginia Dept. of Transportation**

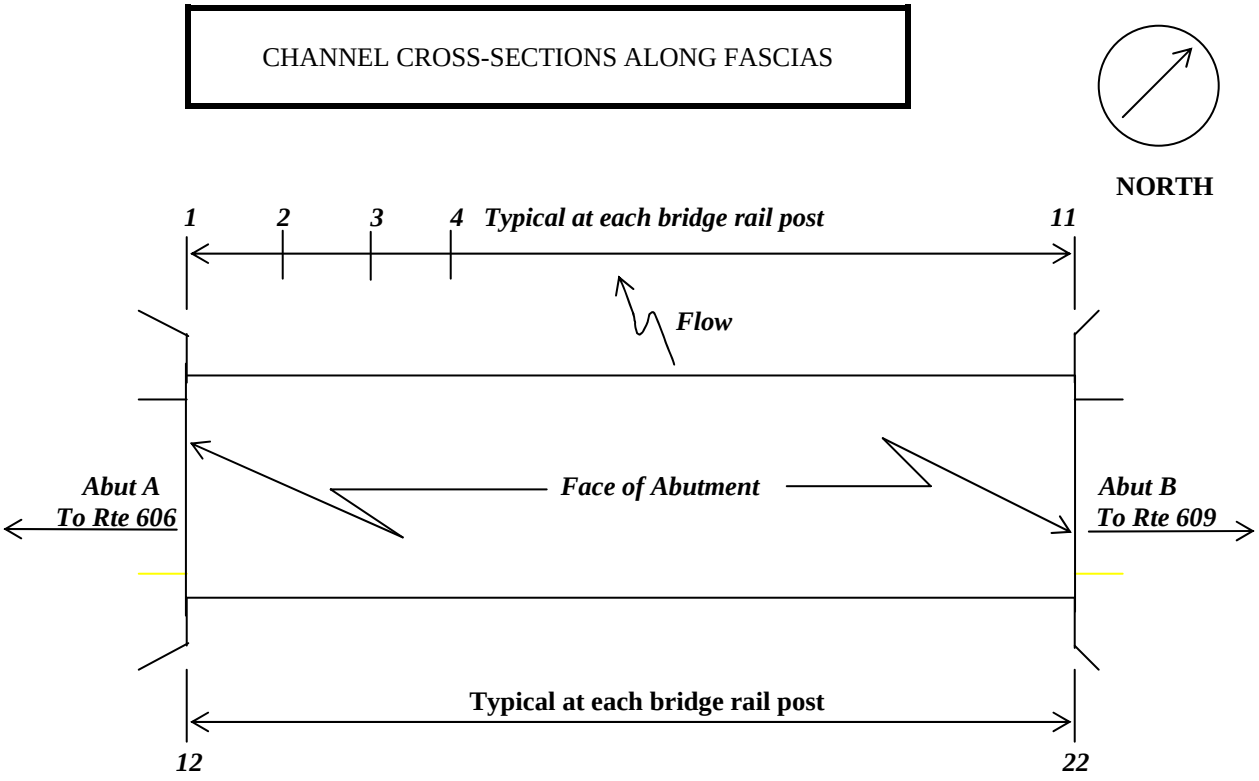
Bridge Inspection Report
Sheet *6* **of** *12*

Team Leader: *Jimmy Beam* **Asst. Team Leader:** *John Walker* **Date:** *12/21/2004*

Feature Carried: *Route 5*

Feature Intersected: *Hangover Creek*

CHANNEL CROSS-SECTIONS ALONG FASCIAS



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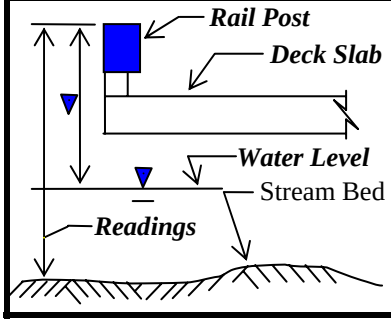
	2000	Water level taken @ post #4 = 25.6'
	2002	Water level taken @ post #17 = 26.9'
	2004	Water level taken @ post #2 = 26.5'

SAMPLE CHANNEL CROSS-SECTION DOCUMENTATION
Figure 1

Bridge Number: *018-1916*

Virginia Dept. of Transportation
Bridge Inspection Report
Sheet *7* **of** *12*

Team Leader: *Jimmy Beam* **Asst. Team Leader:** *John Walker* **Date:** *12/21/2004*

Feature Carried: *Route 5*

Feature Intersected: *Hangover Creek*

CHANNEL CROSS-SECTION READINGS: (FEET)

STA.	Downstream Readings					STA.	Upstream Readings				
Post #	*2000*	*2002*	*2004*			*Post #*	*2000*	*2002*	*2004*		
1	*21.8*	*21.7*	*21.8*			*12*	*21.6*	*21.5*	*21.6*		
2	*21.9*	*21.8*	*21.8*			*13*	*21.9*	*21.9*	*22.0*		
3	*21.8*	*21.7*	*21.9*			*14*	*22.1*	*22.2*	*22.2*		
4	*21.9*	*21.9*	*21.9*			*15*	*22.3*	*22.3*	*22.3*		
5	*21.8*	*21.8*	*21.6*			*16*	*22.5*	*22.4*	*22.4*		
6	*22.0*	*22.1*	*22.0*			*17*	*23.0*	*22.9*	*23.0*		
7	*22.2*	*22.3*	*22.4*			*18*	*22.9*	*22.9*	*22.8*		
8	*22.4*	*22.3*	*22.4*			*19*	*22.6*	*22.5*	*22.5*		
9	*22.3*	*22.3*	*22.3*			*20*	*22.2*	*22.2*	*22.2*		
10	*21.9*	*22.0*	*22.0*			*21*	*21.9*	*21.9*	*22.0*		
11	*21.9*	*21.9*	*22.0*			*22*	*21.3*	*21.2*	*21.3*		

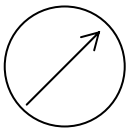
SAMPLE CHANNEL CROSS-SECTION DOCUMENTATION
Figure 2

Team Leader: *Bill Baggins* **Asst. Team Leader:** *Sam Gamgey* **Date:** *6/12/2004*

Feature Carried: *Route 645 (Shiretown Road)*

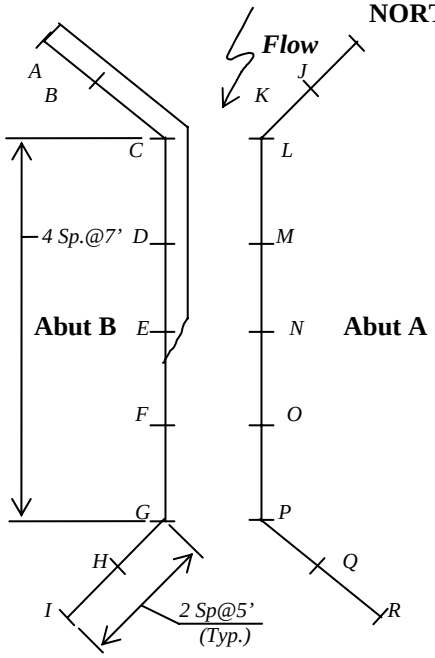
Feature Intersected: *Brandywine Creek*

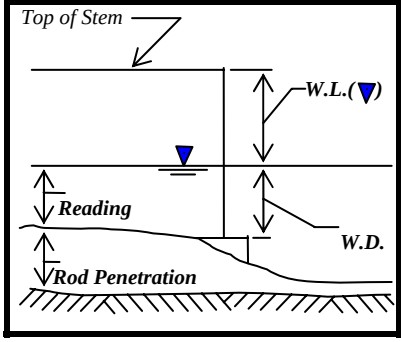
CHANNEL PROFILE ALONG ABUTMENTS: (FEET)



NORTH

LOC	READINGS				ROD PENETRATION			
YEAR>	*2000*	*2002*	*2004*		*2000*	*2002*	*2004*	
A	*2.2*	*2.4*	*2.0*		*0.1*	*0.1*	*0.1*	
B	*2.3*	*2.5*	*2.0*		*0.1*	*0.1*	*0.1*	
C	*2.3*	*2.5*	*1.9*		*0*	*0*	*0*	
D	*2.3*	*2.5*	*2.0*		*0*	*0*	*0*	
E	*2.1*	*2.2*	*1.7*		*0.1*	*0.1*	*0.1*	
F	*1.8*	*2.0*	*1.5*		*0.2*	*0.2*	*0.1*	
G	*1.7*	*1.8*	*1.4*		*0.1*	*0.1*	*0.1*	
H	*1.5*	*1.6*	*1.3*		*0.3*	*0.2*	*0.2*	
I	*1.3*	*1.4*	*1.0*		*0.4*	*0.3*	*0.3*	
J	*2.0*	*2.0*	*1.7*		*0.1*	*0.1*	*0.1*	
K	*1.9*	*1.9*	*1.6*		*0.1*	*0*	*0.1*	
L	*1.9*	*1.9*	*1.5*		*0.1*	*0.1*	*0.1*	
M	*1.7*	*1.6*	*1.4*		*0.1*	*0.1*	*0.2*	
N	*1.5*	*1.4*	*1.2*		*0.2*	*0.2*	*0.3*	
O	*1.3*	*1.1*	*1.0*		*0.2*	*0.2*	*0.3*	
P	*1.0*	*1.0*	*0.7*		*0.3*	*0.3*	*0.2*	
Q	*0.8*	*0.9*	*0.5*		*0.3*	*0.3*	*0.3*	
R	*0.3*	*0.4*	*0.1*		*0.4*	*0.4*	*0.4*	



References	Year	Notes:
	*2000*	***W.L. @ "D" = 6.7'; W.D. @ "D" = 2.1'; Footing***
		Exposed "A" to "E"
	2002	***@ "D" W.L. = 6.5'; W.D. = 2.3'; Typ. To 2000***
	2004	***@ "D" W.L. = 7.0'; W.D. = 1.8'; Typ. To 2000***

SAMPLE CHANNEL PROFILE NEAR SUBSTRUCTURES DOCUMENTATION
Figure 3

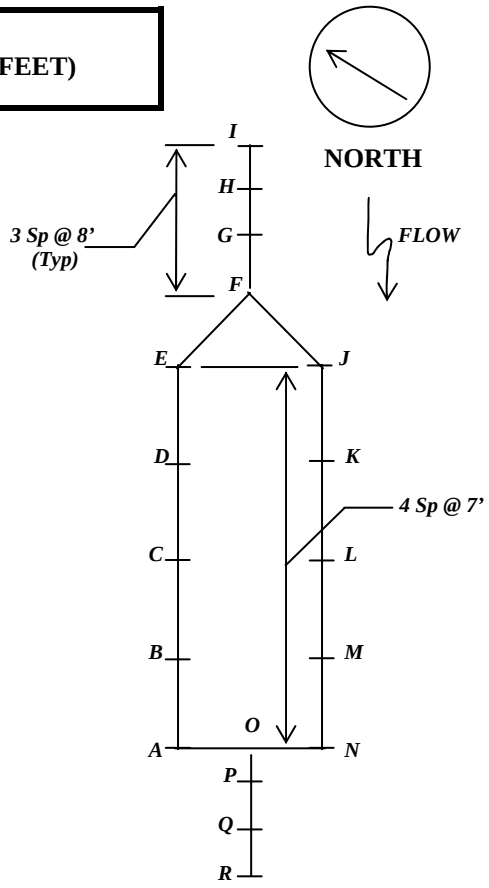
Team Leader: *Fred F. Stone* **Asst. Team Leader:** *B. Rubbel* **Date** *10/10/2004*

Feature Carried: *Route 600 (Wilma Road)*

Feature Intersected: *Betty Creek*

CHANNEL PROFILE ALONG PIERS: (FEET)

LOC	READINGS				ROD PENETRATION			
YEAR>	2000	2002	2004		2000	2002	2004	
A	2.4	2.5	2.4		0.5	0.5	0.5	
B	2.2	2.1	2.1					
C	2.3	2.3	2.2		0.6	0.7	0.7	
D	2.3	2.3	2.3					
E	2.3	2.4	2.4		0.5	0.5	0.5	
F	2.2	2.1	2.1		0.5	0.4	0.4	
G	2.5	2.4	2.3					
H	2.4	2.4	2.4					
I	2.3	2.3	2.3					
J	2.3	2.3	2.2		0.4	0.4	0.4	
K	2.4	2.4	2.4					
L	2.4	2.4	2.4		0.4	0.3	0.4	
M	2.4	2.4	2.4					
N	2.3	2.3	2.3		0.4	0.4	0.5	
O	2.3	2.3	2.3		0.4	0.4	0.4	
P	2.3	2.3	2.3					
Q	2.2	2.2	2.2					
R	2.3	2.3	2.3					



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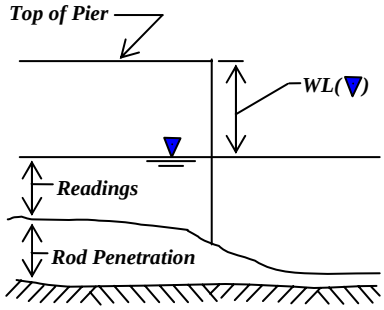
	2000	▽ = 12.5' @ Pt. "A"
	2002	▽ = 12.4' @ Pt. "A"
	2004	▽ = 12.5' @ Pt. "A"

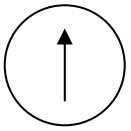
SAMPLE CHANNEL PROFILE NEAR SUBSTRUCTURES DOCUMENTATION
Figure 4

Team Leader: *B. Buney* **Asst. Team Leader:** *E. Fudd* **Date:** *7/04/2004*

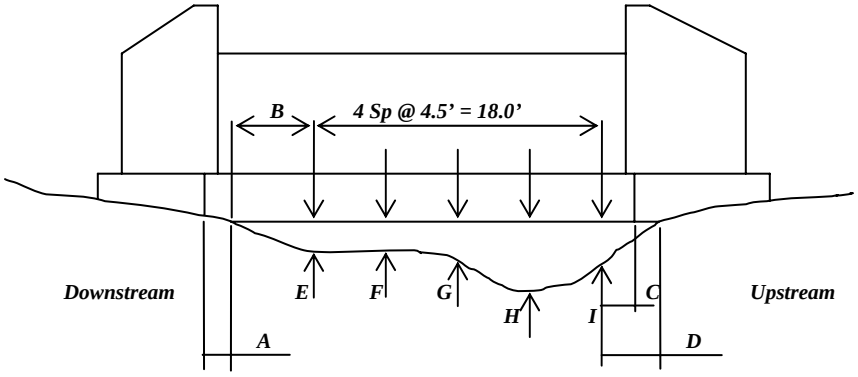
Feature Carried: *Route 609 (Toontown Road)*

Feature Intersected: *Animation Run*

MAPPING OF SCOUR AND EROSION

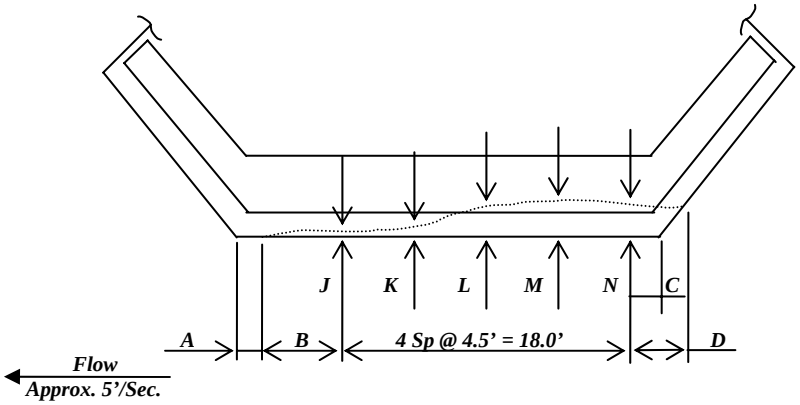


NORTH



ELEVATION VIEW
ABUTMENT "B"

Yr. / Pt.	*2002*	*2004*		
A	***1.5'***	***1.4'***		
B	***5.3'***	***5.4'***		
C	***2.1'***	***2.1'***		
D	***3.8'***	***3.8'***		
E	***0.5'***	***0.5'***		
F	***0.8'***	***0.8'***		
G	***1.0'***	***1.1'***		
H	***1.5'***	***1.6'***		
I	***1.2'***	***1.2'***		
J	***0.3'***	***0.4'***		
K	***0.9'***	***1.0'***		
L	***1.5'***	***1.6'***		
M	***2.0'***	***2.0'***		
N	***1.7'***	***1.7'***		



PLAN VIEW
ABUTMENT "B"

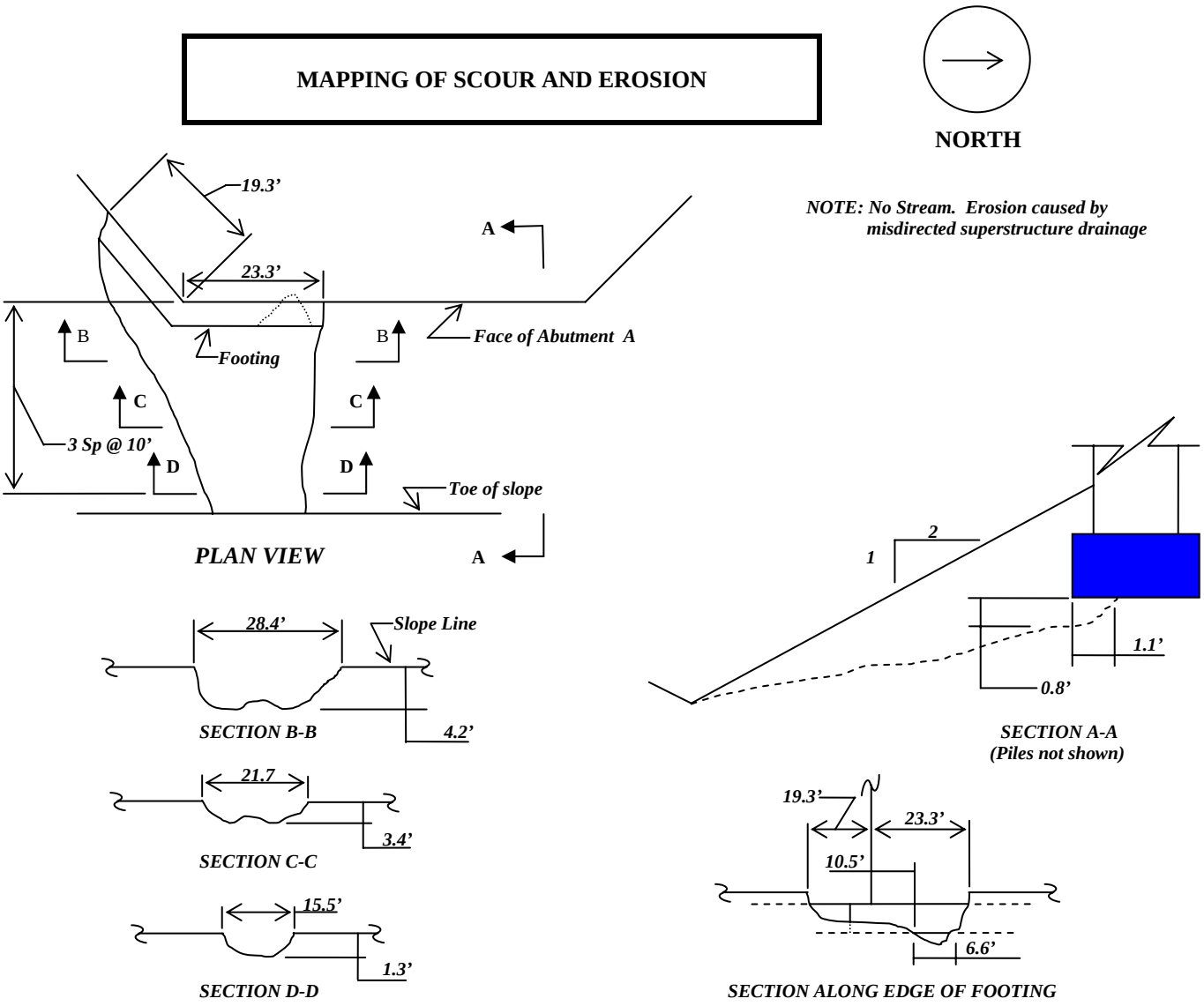
SAMPLE SKETCH OF MAPPING SCOUR AND EROSION AT SUBSTRUCTURES
Figure 5

Team Leader: *Bruce Wayne* **Asst. Team Leader:** *Dick Grayson* **Date:** *02/14/2004*

Feature Carried: ***Route 1 (Jefferson Davis Highway)***

Feature Intersected: ***CSXT R/W***

MAPPING OF SCOUR AND EROSION



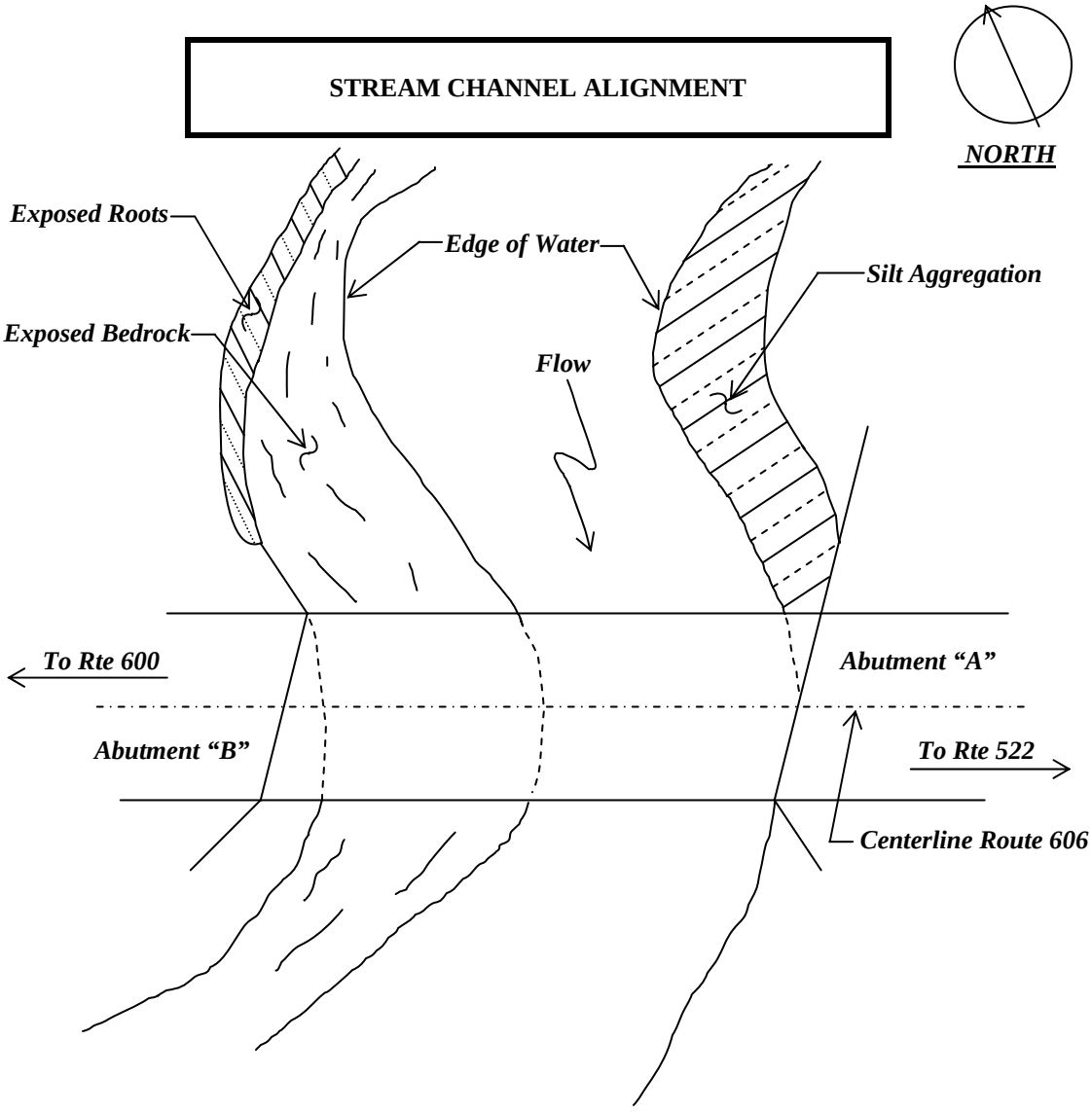
EROSION OF ABUTMENT "A" EMBANKMENT

SAMPLE SKETCH OF MAPPING SCOUR AND EROSION AT SUBSTRUCTURES
Figure 6

Team Leader: *Rob N. Hood* **Asst. Team Leader:** *Al A. Dale* **Date:** *2/14/2004*

Feature Carried: *Route 606 (Sherwood Lane)*

Feature Intersected: *Nottingham Creek*



PLAN VIEW
STREAM ALIGNMENT

SAMPLE STREAM ALIGNMENT SKETCH
Figure 7

SPECIAL CATEGORY INSPECTIONS

For each category of special inspection noted below, the report is to document the results of the inspection using notes, sketches and/or photographs. At each subsequent inspection, an on-site comparison with the previously reported documentation is to be made. If any repairs are urgent, they are to be brought to the attention of the District Structure and Bridge Engineer.

Pin and Hanger Inspections

A hands-on inspection of each pin and hanger assembly is to be made during each scheduled inspection of the structure. An ultrasonic inspection of the pins is to be made in accordance with the following:

1. Redundant structures which have new or newly replaced pins, have backup systems installed or do not demonstrate any signs of distress will require an ultrasonic inspection at each scheduled inspection.
2. Redundant structures with evidence of problems such as frozen hanger bars or other questionable conditions will require an ultrasonic inspection on an annual frequency as a minimum.
3. Non-redundant structures which have new or newly replaced pins, have backup systems or do not show any signs of distress will require an ultrasonic inspection on an annual frequency.
4. Non-redundant structures with evidence of problems such as frozen hanger bars or other questionable conditions will require an ultrasonic inspection every six months as a minimum.

Within the body of the inspection report indicate that the condition of the pin and hanger details were considered when assigning the superstructure general condition rating.

Fatigue Prone Inspections

For steel bridge structural details, fatigue prone details are weld details meeting the AASHTO lower fatigue strength categories of C, D, E, E' or F that have a history of generating localized fatigue cracking.

All structures carrying interstate routes or other routes carrying 500 or more trucks per day are to have a hands-on inspection of fatigue prone categories D, E, E' and F details during the initial and each subsequent routine inspection (category C details will receive a close-up inspection). Inspection folders shall include sketches showing the location and the specific fatigue prone details to be inspected. A statement about the condition of each fatigue prone detail or group of details shall be entered in the inspection report. The term "hands-on" shall be taken literally. "Close-up" shall be interpreted as having a clear unobstructed view of the detail such that it can be determined if defects are present.

Within the body of the inspection report indicate that the condition of the fatigue prone details were considered when assigning the superstructure general condition rating.

Fracture Critical Inspections

Fracture Critical members are metal tension members whose failure would result in the complete or partial collapse of the structure and shall be inspected on a frequency not to exceed 12 months.

Fracture critical members are to receive a hands-on inspection during each inspection. Inspection folders are to include sketches showing the location of members that are fracture critical and any specific details that are to be inspected. A statement about the condition of all fracture critical members shall be entered in the inspection report.

INSTRUCTIONS FOR STRUCTURE RATING

All structures are to be analyzed and load rated in accordance with the NBIS. The AASHTO 'Manual for the Condition Evaluation of Bridges' shall be used for guidelines on analyzing existing bridges.

The individual charged with the overall responsibility for load rating bridges shall be a registered professional engineer. A load rating analysis shall be included in the scope of work for all new or reconstruction in-house and consultant bridge designs.

The analysis and rating assumptions are to be reviewed as part of each scheduled inspection. If a changed condition has occurred since the previous analysis, consideration should be given to updating the rating calculations. If it is determined that a reduction in capacity may take place due to one or more changed conditions noted and highlighted in yellow on the inspection report, the posting may be lowered using engineering judgment until such time as a new analysis can be completed. The new analysis and rating should be completed without delay. For posted bridges, a copy of the rating cover sheet is to be attached to each routine safety inspection report with a statement that the rating has been reviewed as part of the inspection. Analysis calculations are to be filed in the District Structure and Bridge Section's bridge safety inspection folder. The attached 'Cover sheet for Rating Calculations' should be completed and included with every inspection report where the condition of the structure requires a re-analysis of the structure. The rating cover sheet shall in all cases indicate the methodology used in performing the rating analysis.

In order to determine if a restrictive weight limit is needed for a particular structure, the structure must be analyzed for Virginia legal loads. The axle weights and spacings for these legal loads are listed in section 46.2-1126 of the 'Code of Virginia'. The vehicle configurations representing Virginia legal loads and the AASHTO HS20 truck that are to be used to determine if posting is required on Department maintained structures are shown in the attachment titled 'Vehicles for Rating and Analysis'.

A fatigue analysis and evaluation of existing bridges is not required.

Concrete decks supported by longitudinal beams and concrete substructures in fair or good condition need not be analyzed as a part of the load rating analysis.

Any primary load carrying member or detail (such as a girder splice) can control a structure's live load capacity. Should any such member or detail be suspected of not performing up to its design capacity, that member or detail shall be considered in the overall structural analysis.

The attached 'Equivalent Capacity Coefficients' charts can be used to assist in converting from one vehicle's rating to another.

INSTRUCTIONS FOR STRUCTURE RESTRICTION POSTING

Concrete structures that do not have plans of their structural details, have been carrying traffic for a substantial length of time, and do not show signs of distress need not be posted.

If a structure rates less than 27 tons using the single unit vehicle or 40 tons using the truck and semi-trailer legal loads, the structure shall have restrictive weight limit signs erected in accordance with Mobility Management Division memorandum MM-313. Overhead structures having an actual vertical clearance less than or equal 14'-5" shall be signed in accordance with Mobility Management Division Memorandum MM-314. The vertical clearance posted on these signs shall be 3 inches less that the actual measured value.

Should the inspection find that restrictive signs are not in compliance with MM-313 and/or MM-314, a form similar to the attached Bridge Signage form shall be used to alert the appropriate personnel. Improper restrictive signage shall be addressed within two working days. Modifications to HTRIS regarding revised field restrictions shall be accomplished within five working days.

Capacity Posting Level

On steel and timber superstructures, the capacity at a load level midway between inventory and operating may be used to determine if posting is required. In special situations, engineering judgment may be used to post a structure at any level between inventory and operating.

For concrete superstructures, the capacity at the operating level may be used to determine if posting is required.

The District Structure and Bridge Engineer shall determine the most appropriate method of structural analysis used for setting posting levels.

CC: Chief Engineer
Chief of Systems Operations
Director of Virginia Transportation Research Council
Division Administrators under the Chief Engineer
Division Administrators under the Chief of Systems Operations
District Administrators
Residency Administrators
Federal Highway Administration

ATTACHMENTS

VIRGINIA DEPARTMENT OF TRANSPORTATION

VDOT

STRUCTURE AND BRIDGE DIVISION

Critical Recommendation

for Posting, Repair and/or Strengthening

Route: _____ NBIS (Y/N) ____

Over: _____

County: _____

Str. No.: _____

Located: _____ Mi. To: _____

Mi. From: _____

Inspected By: _____ Inspection Date: _____

WHEN A CRITICAL CONDITION IS DISCOVERED SEND FORM:

To: _____ From: _____ Date: _____

Residency Administrator — District Structure & Bridge Engineer

cc: District Maintenance Engineer
State Structure and Bridge Engineer
Environmental Division

AFTER THE CRITICAL CONDITION IS REPAIRED SEND FORM:

To: _____ From: _____ Date: _____

District Structure & Bridge Engineer — Residency Administrator

cc: State Structure & Bridge Engineer

For NBIS structures, once work has been completed the State Structure & Bridge Engineer shall forward this form to the FHWA Division Administrator in Richmond, Virginia. Federal Structure ID No:0000000000 _____

CRITICAL CONDITION REQUIRING IMMEDIATE ATTENTION

- ☐ Immediate performance of work on fracture critical member(s) is needed.
- ☐ Immediate correction of scour and/or hydraulic problem is needed.
- ☐ Condition rating of 3 or less for deck, superstructure and/or substructure.
- ☐ Condition rating of 3 or less for waterway adequacy.
- ☐ Immediate work to prevent substantial reduction in safe load capacity and/or for the safety of the traveling public.

Action required (include date work must be completed): _____

ESTIMATED COST - $ _____

BELOW TO BE FILLED OUT BY RESIDENCY ADMINISTRATOR WHEN WORK HAS BEEN COMPLETED

Action taken (include date work was completed): _____

Signature _____

Residency Administrator

Follow-up Inspection after work is complete by: _____

Bridge Safety Inspector — Date

VIRGINIA DEPARTMENT OF TRANSPORTATION

STRUCTURE AND BRIDGE DIVISION

Critical Recommendation

for Posting, Repair and/or Strengthening

Route: _____ NBIS (Y/N) _____

Over: _____

Municipality/Agency: _____

Str. No.: _____

Located: _____ Mi. To: _____

Mi. From: _____

Inspected By: _____ Inspection Date: _____

WHEN A CRITICAL CONDITION IS DISCOVERED SEND FORM:

To: _____ From: _____ Date: _____

Bridge Safety Inspection Engineer

cc: State Structure & Bridge Engineer
District Structure & Bridge Engineer

AFTER THE CRITICAL CONDITION IS REPAIRED SEND FORM:

To: _____ From: _____ Date: _____

District Structure & Bridge Engineer — Bridge Safety Inspection Engineer

cc: State Structure & Bridge Engineer

For NBIS structures, once work has been completed the State Structure & Bridge Engineer shall forward this form to the FHWA Division Administrator in Richmond, Virginia. Federal Structure ID No:0000000000 _____

CRITICAL CONDITION REQUIRING IMMEDIATE ATTENTION

- ☐ Immediate performance of work on fracture critical member(s) is needed.
- ☐ Immediate correction of scour and/or hydraulic problem is needed.
- ☐ Condition rating of 3 or less for deck, superstructure and/or substructure.
- ☐ Condition rating of 3 or less for waterway adequacy.
- ☐ Immediate work to prevent substantial reduction in safe load capacity and/or for the safety of the traveling public.

Action required (include date work must be completed): _____

ESTIMATED COST - $ _____

BELOW TO BE FILLED OUT BY MUNICIPALITY/AGENCY WHEN WORK HAS BEEN COMPLETED

Action taken (include date work was completed): _____

Signature _____

Follow-up Inspection after work is complete by: _____

Bridge Safety Inspector Date

Vehicles for Rating and Analysis

HS20
GVW = 36 Tons
C. G. is 18.67' from axle #1

Axle No	Weight (lbs.)	Distance to Next Axle
1	8,000	14'
2	32,000	14'
3	32,000	

or a uniform load of 640#/l. f. plus a concentrated load of 18,000# for moment or a load of 26,000# for shear.

Legal Load – Single Unit Truck
GVW = 27 Tons
C. G. is 13.85' from axle #1

Axle No	Weight (lbs.)	Distance to Next Axle
1	20,000	20'
2	17,000	4'
3	17,000	

Legal Load – Truck and Semi-trailer
GVW = 40 Tons
C. G. is 25.92' from axle #1

Axle No	Weight (lbs.)	Distance to Next Axle
1	12,000	10'
2	17,000	4'
3	17,000	33'
4	17,000	4'
5	17,000	

Cover Sheet for Rating Calculations

Rte.: _____
Over: _____
County: _____
Str. No.: _____
Method: _____
Rated by: _____ Date: _____
Checked by: _____ Date: _____

POSTING RATING – Virginia Legal Loads
(at _____ % Yield)

Single Unit _____ Tons – Controlling Member _____

Truck and Semi-trailer _____ Tons – Controlling Member _____

NBIS RATINGS
Note: The rating is the gross tonnage on a HS20 vehicle.

HS20 at Inventory _____ Tons – Controlling Member

HS20 at Operating _____ Tons – Controlling Member

Equivalent Capacity Coefficients - Moment

Simple Span Longitudinal Members Controlled by Moment

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi-trailer			School Bus	H20	
							Truck	Lane
2	1.0000	1.2000	2.0915			0.6470	0.5560	0.5560
4	1.0000	1.2000	2.0915			0.6540	0.5560	0.5560
6	1.0000	1.2000	2.0915			0.6520	0.5560	0.5560
8	1.0000	1.2000	1.8591			0.6540	0.5560	0.5560
10	1.0000	1.1029	1.6340			0.6510	0.5560	0.5560
12	1.0000	1.0165	1.5059			0.6530	0.5560	0.5560
14	1.0000	0.9608	1.4234			0.6520	0.5560	0.5560
15	1.0000	0.9398	1.3923			0.6520	0.5560	0.5560
16	1.0000	0.9220	1.3659			0.6530	0.5560	0.5560
18	1.0000	0.8934	1.3235			0.6530	0.5560	0.5560
20	1.0000	0.8715	1.2911			0.6540	0.5560	0.5560
22	1.0000	0.8541	1.2247			0.6530	0.5560	0.5560
24	1.0000	0.8430	1.1722			0.6550	0.5560	0.5560
25	1.0000	0.8647	1.1870			0.6770	0.5760	0.5760
26	1.0000	0.8848	1.2007			0.6970	0.5930	0.5930
28	1.0000	0.9210	1.2252			0.7350	0.6170	0.6170
30	1.0000	0.9526	1.2465			0.7670	0.6360	0.6360
32	1.0000	0.9804	1.2651			0.7760	0.6520	0.6520
34	1.0000	1.0064	1.2833			0.7850	0.6660	0.6660
35	1.0000	1.0243	1.2991			0.7930	0.6770	0.6770
36	1.0000	1.0411	1.3139			0.8020	0.6880	0.6880
38	1.0000	1.0628	1.3406			0.8160	0.7060	0.7060
40	1.0000	1.0585	1.3641			0.8280	0.7230	0.7230
42	1.0000	1.0547	1.3850			0.8390	0.7370	0.7370
44	1.0000	1.0515	1.4037			0.8480	0.7500	0.7500
45	1.0000	1.0500	1.4123			0.8530	0.7560	0.7560
46	1.0000	1.0486	1.4204			0.8570	0.7620	0.7620
48	1.0000	1.0460	1.4356			0.8640	0.7730	0.7730
50	1.0000	1.0437	1.4494			0.8710	0.7830	0.7830
52	1.0000	1.0416	1.4620			0.8770	0.7920	0.7920
54	1.0000	1.0397	1.4735			0.8330	0.8000	0.8000
55	1.0000	1.0388	1.4789			0.8860	0.8040	0.8040
56	1.0000	1.0380	1.4841			0.8880	0.8080	0.8080
58	1.0000	1.0364	1.4939			0.8930	0.8150	0.8080
60	1.0000	1.0350	1.5030			0.8970	0.8210	0.8030
62	1.0000	1.0336	1.5114			0.9010	0.8280	0.7980

EQUIVALENT CAPACITY COEFFICIENTS - MOMENT

Simple Span Longitudinal Members Controlled by Moment

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi-trailer			School Bus	H20	
							Truck	Lane
64	1.0000	1.0324	1.5192			0.9050	0.8340	0.7920
65	1.0000	1.0318	1.5229			0.9060	0.8360	0.7900
66	1.0000	1.0312	1.5265			0.9080	0.8390	0.7870
68	1.0000	1.0302	1.5317			0.9110	0.8440	0.7810
70	1.0000	1.0292	1.5047			0.9150	0.8490	0.7750
75	1.0000	1.0269	1.4480			0.9210	0.8600	0.7590
80	1.0000	1.0250	1.4027			0.9270	0.8690	0.7420
85	1.0000	1.0234	1.3658			0.9320	0.8770	0.7260
90	1.0000	1.0219	1.3351			0.9360	0.8840	0.7090
95	1.0000	1.0207	1.3092			0.9400	0.8910	0.6930
100	1.0000	1.0195	1.2870			0.9430	0.8960	0.6770
105	1.0000	1.0185	1.2678			0.9460	0.9010	0.6620
110	1.0000	1.0176	1.2510			0.9490	0.9060	0.6470
115	1.0000	1.0168	1.2362			0.9520	0.9100	0.6320
120	1.0000	1.0160	1.2231			0.9540	0.9140	0.6180
125	1.0000	1.0153	1.2113			0.9560	0.9180	0.6050
130	1.0000	1.0147	1.2007			0.9580	0.9210	0.5920
135	1.0000	1.0141	1.1911			0.9590	0.9240	0.5790
140	1.0000	1.0136	1.1824			0.9610	0.9260	0.5670
145*	1.0000	1.0138	1.1754			0.9630	0.9300	0.5560
150*	1.0000	1.0345	1.1925			0.9840	0.9520	0.5560
160*	1.0000	1.0761	1.2278			1.0280	0.9960	0.5560
170*	1.0000	1.1181	1.2644			1.0710	1.0400	0.5560
180*	1.0000	1.1604	1.3021			1.1140	1.0840	0.5560
190*	1.0000	1.2030	1.3406			1.1580	1.1270	0.5560
200*	1.0000	1.2457	1.3799			1.2010	1.1720	0.5560

* - HS20 lane load was used for these spans

Equivalent Capacity Coefficients - Shear

Simple Span Longitudinal Members Controlled by Shear

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi-trailer			School Bus	H20	
							Truck	Lane
2	1.000	1.200	2.092			0.653	0.566	0.566
4	1.000	1.200	2.092			0.653	0.556	0.556
6	1.000	1.059	1.569			0.653	0.556	0.556
8	1.000	0.941	1.394			0.653	0.556	0.556
10	1.000	0.882	1.307			0.653	0.556	0.556
12	1.000	0.847	1.255			0.653	0.556	0.556
14	1.000	0.824	1.220			0.653	0.556	0.556
15	1.000	0.869	1.253			0.696	0.465	0.465
16	1.000	0.908	1.280			0.734	0.505	0.505
18	1.000	0.971	1.321			0.768	0.570	0.570
20	1.000	1.020	1.352			0.784	0.620	0.620
22	1.000	1.059	1.375			0.796	0.660	0.660
24	1.000	1.091	1.393			0.806	0.692	0.692
25	1.000	1.077	1.400			0.810	0.706	0.706
26	1.000	1.066	1.407			0.814	0.718	0.718
28	1.000	1.046	1.420			0.821	0.741	0.741
30	1.000	1.041	1.445			0.835	0.760	0.760
32	1.000	1.037	1.467			0.848	0.776	0.776
34	1.000	1.034	1.486			0.858	0.791	0.787
35	1.000	1.033	1.494			0.863	0.797	0.789
36	1.000	1.032	1.502			0.868	0.803	0.790
38	1.000	1.029	1.517			0.876	0.814	0.791
40	1.000	1.027	1.530			0.883	0.824	0.790
42	1.000	1.026	1.541			0.889	0.833	0.789
44	1.000	1.024	1.551			0.895	0.841	0.786
45	1.000	1.023	1.556			0.898	0.845	0.785
46	1.000	1.023	1.560			0.900	0.849	0.783
48	1.000	1.022	1.569			0.905	0.856	0.779
50	1.000	1.021	1.576			0.909	0.862	0.775
52	1.000	1.020	1.583			0.913	0.867	0.770
54	1.000	1.019	1.545			0.916	0.872	0.765
55	1.000	1.018	1.526			0.918	0.875	0.762
56	1.000	1.018	1.509			0.920	0.877	0.759
58	1.000	1.017	1.478			0.922	0.882	0.753
60	1.000	1.016	1.451			0.925	0.886	0.747
62	1.000	1.016	1.427			0.928	0.890	0.741

EQUIVALENT CAPACITY COEFFICIENTS - SHEAR

Simple Span Longitudinal Members Controlled by Shear

Span (Feet)	HS20 Gross	Single Unit Truck	Truck & Semi-trailer			School Bus	H20	
							Truck	Lane
64	1.000	1.015	1.405			0.930	0.893	0.735
65	1.000	1.015	1.395			0.932	0.895	0.732
66	1.000	1.015	1.385			0.933	0.897	0.729
68	1.000	1.014	1.367			0.936	0.900	0.723
70	1.000	1.014	1.351			0.937	0.903	0.716
75	1.000	1.013	1.315			0.941	0.910	0.700
80	1.000	1.012	1.287			0.945	0.915	0.685
85	1.000	1.011	1.263			0.949	0.921	0.669
90	1.000	1.010	1.243			0.952	0.925	0.654
95	1.000	1.010	1.225			0.955	0.929	0.640
100	1.000	1.009	1.210			0.957	0.933	0.625
105	1.000	1.009	1.197			0.959	0.936	0.612
110	1.000	1.008	1.185			0.961	0.939	0.598
115	1.000	1.008	1.175			0.963	0.942	0.585
120	1.000	1.007	1.166			0.964	0.944	0.573
125*	1.007	1.007	1.158			0.966	0.946	0.556
130*	1.018	1.018	1.163			0.967	0.960	0.556
135*	1.039	1.039	1.180			0.969	0.981	0.556
140*	1.060	1.060	1.198			0.970	1.003	0.556
145*	1.081	1.081	1.216			0.970	1.025	0.556
150*	1.102	1.102	1.234			0.972	1.047	0.556
160*	1.145	1.145	1.272					
170*	1.188	1.188	1.310					
180*	1.231	1.231	1.349					
190*	1.274	1.274	1.389					
200*	1.317	1.317	1.429					

* - HS20 lane load was used for these spans

VIRGINIA DEPARTMENT OF TRANSPORTATION
Intra-Departmental Memorandum

Structural Preventive Maintenance Program

Date: _____
Route: _____ **Over:** _____

To: _____
Residency Administrator

City/County: _____
Structure No: _____
Inspected By: _____

From: _____
District Structure & Bridge Engineer

Inspection Date: _____

Inspection by the District Bridge Safety Inspection Team has revealed that the reference bridge requires preventive maintenance. These items, with cost estimates are:

		Approximate Cost	Date Work Performed	Performed By
Clean Deck	☐			
Seal Expansion Joints	☐			
Clean Abutment Seats	☐			
Clean Pier Seats	☐			
Clean Bearings	☐			
Clean Truss Panel Points	☐			
Clear Debris from Scuppers	☐			
Clean Other (Identify) _____	☐			
***Clear Debris** (Identify) _____	☐			
Other (Identify) _____	☐			

May include removing silt from boxes/culverts/pipes, removing debris between steel beams or at piers

The above deficiencies were corrected on the dates indicated.

Signature: _____
Residency Administrator

Once the above deficiencies have been corrected, please forward the original of this form to the District Structure and Bridge Engineer.

VIRGINIA DEPARTMENT OF TRANSPORTATION

VDOT

STRUCTURE AND BRIDGE DIVISION

Route: _____

Over: _____

County: _____

Str. No.: _____

Located: _____ Mi. To: _____

Mi. From: _____

Priority Repair Recommendations

for Repair and/or Strengthening

Inspected By: _____ Inspection Date: _____

WHEN BRIDGE REPAIRS ARE NEEDED SEND FORM:

To: _____ From: _____ Date: _____

Residency TOM — District Bridge Safety Engineer

cc:

AFTER THE BRIDGE IS REPAIRED SEND FORM:

To: _____ From: _____ Date: _____

District Bridge Safety Engineer — Residency TOM

cc:

REPAIRS NEEDED: _____

ESTIMATED COST - $

ACTION TAKEN: _____

ACTUAL COST - $

Virginia Department of Transportation
Intra-Departmental Memorandum

Bridge Signage

City/County: _____
Route: _____ **Over:** _____
Structure No.: _____

To: _____ **From:** _____ **Date:** _____
Residency Administrator **District Structure & Bridge Engineer**

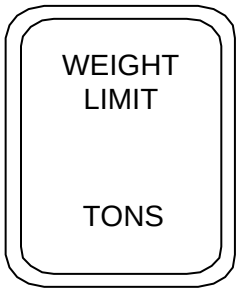
Signage affected:

☐ **Weight Restriction** ☐ **Vertical Clearance** ☐ **Object Markers**

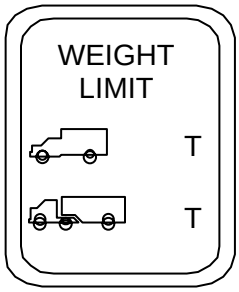
Inspection and/or analysis by the District Structure and Bridge Section revealed that the posting for the above referenced bridge is:

☐ Required and no posting was in place.
☐ No longer required and posting signs need to be removed.
☐ Incorrect and needs to be lowered.
☐ Incorrect and needs to be raised.
☐ Missing and need to be replaced.
☐ Damaged and need to be replaced.
☐ Obscured.
☐ Other: _____
_____

Weight Posting Sign shall be as indicated below:



R12-1



R12-5
(Modified)

The above bridge posting sign deficiency was corrected on _____

Signature: _____
Residency Administrator

Once the above deficiency has been corrected, please forward the original of this form to the District Structure and Bridge Engineer.